University of California, San Diego
Math 194
Mathematical Finance
Winter 2006
Course Information

Description: In 1997, Robert Merton and Myron Scholes received the Nobel prize for their work on pricing securities derivatives. An example of a securities derivative is a European put option, which is a contract that gives the owner the right, but not the obligation, to sell a specific security (e.g., a particular stock) at a set time for a set price. By buying such an option, an investor can hedge against the risk associated with market volatility. For example, suppose that an investor believes that the price of a certain stock will be high at some time in the future. In addition to purchasing the stock, the investor could also purchase a put option. Then, if the market falls the investor can exercise the put option to minimize loss.

Pricing securities derivatives emerged as an important concern in the late 1960's and early 1970's when a relaxation in the regulations allowed insurance companies and banks to invest in the derivatives market. At about that time, two economists, Fisher Black and Myron Scholes, developed a mathematically based pricing strategy, which Robert Merton later simplified and expanded. This work had a profound impact on the trading practices in financial markets worldwide. Sadly, Black passed away prior to 1997, and therefore was ineligible to be a co-Nobel prize recipient.

In the course, we will examine a simplified version of this body of work. In particular, we will analyze the multi-period Cox-Ross-Rubenstien (CRR) model and the finite market model using some of the key principles and methodologies that Black, Scholes, and Merton developed to construct their derivatives pricing theory. Despite the fact that these models are very simple, the analysis will illustrate certain essential aspects of their work such as dynamic hedging and the risk neutral probability measure. Optional topics include using the risk neutral proability to solve certain portfolio optimization problems and deriving some of the Black-Scholes pricing formulas as scaling limits of the CRR models.

Objectives: The aim of the course is to introduce students to stochastic modeling via the the study of models for financial markets.

Instructor: Prof. Puha; AP&M 7230; 4-2623; apuha@math.ucsd.edu;
http://www.math.ucsd.edu/~apuha.

Lecture Time: Peterson Hall 102, MWF, 4pm-4:50pm

Instructor Office Hours: Mondays and Fridays, 3pm-3:45pm; Wednesdays 12:00pm-12:45pm.

Virtual Office Hours: Questions sent via email will be responded to during office hours, if time permits. Students physically present have priority.

Email Policies: To avoid having your message routed into the instructor's spam folder,

please send messages from your UCSD student email account. You are responsible for reading all messages sent to your student email address.

Course Web Page: http://www.math.ucsd..edu/~apuha/math194/.

Teaching Assistant: Nam Lee; nhlee@math.ucsd.edu;

Discussion Section: SOLIS 111, Mondays, 5-5:50pm.

Teaching Assistant Office Hours: AP&M 2402, Calculus Lab, Tuesdays, 4pm-5:30pm

Required Textbook: R. J. Williams. Introduction to the Mathematics of Finance. Available for $7 from AS soft reserves.

Other References:

- Stanely R. Pliska. Introduction to Mathematical Finance: Discrete Time Models. Blackwell, 1997.
- J. Hull, Options, Futures and other Derivative Securities, Prentice Hall, Fourth Edition, 2000.
- S. Ross, An Introduction to Mathematical Finance, Options and other topics, Cambridge University Press, 1999.
- J. Stampfli and V. Goodman, The Mathematics of Finance: Modeling and Hedging, Brooks/Cole, Pacific Grove, CA, 2001.
- P. Wilmott et al., The Mathematics of Financial Derivatives, Cambridge University Press, 1995.

Prerequisites:

- Math 20D Introduction to Differential Equations;
- Math 20F Linear Algebra;
- Math 180A Introduction to Probability or Math 183 Statistical Methods.

Preparing for Class: Please review the notes from the prior lecture and do all the assigned exercises, even if that requires a visit to office hours. This will prepare you to build on that knowledge in lecture. Otherwise, you may find yourself lost in the notation and confused.

Missed Lectures: It is your responsibility to get the lecture notes from one of your fellow classmates in the event that you are able to attend a lecture.

Homework: Homework assignments will be assigned via the course webpage and due at the BEGINNING of lecture on the due date. Clear, complete, fully justified solutions are

required for full credit. Presentation also counts. Papers must be stapled and answers must be legible and well organized. NO LATE HOMEWORK will be accepted. Questions are welcome in discussion section and office hours. Students are expected to make an ernest effort to solve a problem and to clarify their questions before seeking help. Your lowest scoring assignment will be dropped from the computation of your grade.

Turning Homework in Early: If for some reason you do not plan to come to lecture the day that homework is due and want to get credit, you can place it in the course homework box on the second floor of AP&M AT LEAST 30 minutes prior to the time of the lecture meeting.

Exams: Two midterm exams and one final exam will be given. To prepare, students should review the homework problems and the lecture notes. Calculators, cell phones, and all other electronic devices are not allowed. Such devices should be turned off and stowed securely in your backpack, i.e., not in your pocket or other easily accessible location. NO MAKEUP EXAMS. Plan accordingly.

Students should bring any grading/scoring concerns to the attention of the professor the same day that the exam is returned. If you unable to discuss this with the professor in person, write a note and leave the note and the exam in the professor's mailbox, which is located on the 7th floor the AP&M building

Midterm Exam Dates:
Exam One: Friday, February 3, 2006
Exam Two: Friday, March 3, 2006.

Final Exam: The exam is comprehensive. Please bring a self addressed, stamped postcard if you would like your grade mailed to you.

Final Exam Date: Tuesday, March 21, 2006, 3pm-6pm

Grades: Your grade will be calculated from the best of the following options:

Homework	Exam One	Exam Two	Final Exam	Total
15%	20%	20%	45%	100%
15%	0%	20%	65%	100%
15%	20%	0%	65%	100%

Academic Honesty: Academic dishonesty will NOT be tolerated. Violations will be reported to the Academic Integrity Coordinator.

Academic Honesty and Homework: The instructor and teaching assistant recognize that students benefit from discussing approaches to the assigned homework with their classmates. This practice is encouraged. However, it is expected that each student will make an independent attempt to solve any given homework problem and prepare questions before

discussing it with his/her classmates. It is also expected that each student will submit an independent final write up of his/her solution. To achieve this, the final write up should be completed without referring to a book or notes and without asking others for assistance. The student should continue to study and ask questions until a final independent write up can be achieved.

Cell Phones: TURN THEM OFF during class.